Plotting Trends
A Periodic Table Activity

Introduction

Does ionization energy increase going up or down a column in the periodic table? Do atoms get smaller or larger from right to left across a row? Most students have a hard time answering these questions. In this cooperative activity, students use microscale reaction plates and straws of different lengths to construct three-dimensional bar-type charts of element properties. Let students discover for themselves the existence and direction of periodic trends.

Purpose

You will see a visual representation of various trend on the periodic table in a 3D model you create.

Materials

Calculator, at least 1 per student group
Index cards, 4 x 6 inches, 4
Reaction plates, 96-well (8 × 12 layout),
Periodic table, 2
Straws, 40
Scissors, at least 1 per student group
1 Metric ruler, marked in millimeters,
Plumber's putty or clay (optional)

Safety Precautions

Careful with the scissors

Procedure

1. in your group of four (4) student split into to pairs A and B. Obtain a periodic table, a reaction plate, a metric ruler, scissors, and 40 plastic straws.

2. Each group chooses or is assigned one element property: atomic mass (periodic table), atomic radius (Appendix A, Table A-3), ionization energy(Appendix A, Table A-3) , electronegativity (Page 303 Table 12.1), electron affinity (page 263 table 10.5), density (Appendix A, Table A-3), or melting point(Appendix A, Table A-3).

3. Find your assigned physical property on the periodic table.

4. Find the **maximum** value of the assigned physical property for the elements 1–20, 31–38, and 49–54 (these are the representative or main group elements in periods #1–5). Partner pair A will do the calculation for elements 1-18 and partner pair B will do all the calculations for elements 19, 20, 31-35, 37, 38, & 49-54

Example: The maximum value of the density for these elements is 7.31 g/cm^3 (for Sn).

5. Let the length of the straw minus one cm represent this maximum value. This length will be the scale for all of the other values of the density of the elements. *Example:* For a straw that is 19.5 cm long, a straw length of 18.5 cm will represent a density of 7.31 g/cm^3. The scale is thus 18.5 cm = 7.31 g/cm^3. Round off straw lengths to 0.1 cm (1 mm).

6. Using this "straw" scale as a ratio, calculate the straw length that is needed to represent the assigned property for each element in the list.

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Example: The density of beryllium is 1.85 g/cm^3. Solving Equation 1 for the straw length (*sl*) shows that a straw length of 4.7 cm is needed to represent the density of Be. Round off all straw lengths to 0.1 cm.

$$\frac{18.5cm}{7.31g/cm^3} = \frac{sl}{1.85g/cm^3} \qquad \textit{Equation 1}$$

$$sl = (18.5 \times 1.85)/7.31 = 4.7 \text{ cm}$$

7. Add 1.0 cm to the calculated straw length for each element and cut a straw to that length.
Example: Cut a straw 5.7 cm
(4.7 cm + 1.0 cm) long to represent beryllium.

8. Place the straw in the reaction plate according to the position of the element in the periodic table. Remember, the transition elements are not included in the list of representative elements.
Example: Beryllium (period 2, Group IIA) is placed in row 2, column 2.

9. *(Optional)* Place a pea-sized amount of plumber's putty or clay in the bottom of each straw before placing it in the reaction plate. This will make the resulting "straw chart" more stable.

10. Repeat steps 5–9 for each element in the list.

11. Determine the nature of any periodic trend that may exist for the assigned property of the elements and propose an explanation for the observed trend.

12. Create a descriptive card to be displayed with the three-dimensional chart. Include the following information on the card:
(1) Names of group members; (2) the assigned physical property of the element;
(3) Description of the observed trend; (4) proposed explanation for the trend.